Does Effectiveness of a Brief Substance Use Treatment Depend on PTSD? An Evaluation of Motivational Enhancement Therapy for Active-Duty Army Personnel

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ABSTRACT. Objective: Posttraumatic stress disorder (PTSD) with comorbid substance use disorders (SUDs) has been associated with poorer treatment outcomes. The present study examined associations between provisional PTSD at baseline and 3 months with 6-month treatment outcomes from either a one-session motivational enhancement therapy (MET) or education intervention addressing substance use. **Method:** Secondary analyses were conducted on a randomized clinical trial comparing a novel MET intervention to an educational intervention for Army personnel with SUD who were not engaged in SUD treatment (n = 242; 92.1% male). We compared three groups with complete data on baseline and 3-month provisional PTSD: individuals without provisional PTSD at baseline (n = 98), those with provisional PTSD remitted by 3 months (n = 42), and those with provisional PTSD unremitted at 3 months (n = 53) on alcohol use frequency, quantity, consequences, and related diagnoses. **Results:** Individuals with unremitted provisional PTSD were at increased risk for moderate/severe alcohol use disorder at 6 months relative to those without baseline provisional PTSD (odds ratio = 4.53, p = .007). The effect of MET on drinks per week at 6 months (controlling for baseline) differed with a significant effect of MET for individuals with remitted provisional PTSD (count ratio = 0.41, p = .005). **Conclusions:** Both interventions were effective in reducing drinking even for those with provisional PTSD, although, compared with education, MET had slightly better effects on reducing drinking quantity for those with remitted PTSD. Findings suggest that PTSD remission may serve as an early prognostic indicator of long-term alcohol use changes, or alternatively, delivery of MET during heightened transitory distress may be most effective for reducing alcohol use. (*J. Stud. Alcohol Drugs, 83,* 924–933, 2022)

U.S. SERVICE MEMBERS are at high risk for both posttraumatic stress disorder (PTSD) and substance use disorders (SUDs; Allen et al., 2016; Bray et al., 2013; Fulton et al., 2015). Among active-duty service members with a mental health disorder, 8.3% had PTSD, 9.9% had an alcohol use disorder (AUD), and 3.3% had an SUD (Stahlman & Oetting, 2018). PTSD/SUD are often comorbid, as 63%–76% of veterans with an SUD also have a PTSD diagnosis (Roberts et al., 2016).

Of particular concern, treatment of comorbid PTSD/SUD is associated with more complex and costly courses of treatment and worse outcomes than either PTSD or SUD alone (McCauley et al., 2012; Najavits, 2005). PTSD symptoms can lead to increased drug or alcohol cravings (Back et al., 2014; Coffey et al., 2002). Accordingly, in substance use recovery programs, difficulties engaging and retaining patients with PTSD are common (DiClemente et al., 2008; Jarnecke et al., 2019; Torchalla et al., 2012), and unremitted PTSD is associated with treatment dropout (McCauley et al., 2012; Najavits, 2005).

Motivational enhancement therapy (MET) is a therapeutic approach developed to resolve ambivalence about a behavior by evoking internally salient reasons to change (Miller et al., 1999). MET has been used to increase engagement in treatment and directly reduce substance use (Lundahl et al., 2010; Miller et al., 1988). Delivered as a brief telephone- or web-based intervention, MET reduced drinking and related consequences among active-duty personnel (Pemberton et al., 2011; Walker et al., 2017). Similarly, a brief group-based alcohol intervention that included components of MET (nor-

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mative feedback, pros/cons, personalized feedback on drinking risks; Rodriguez et al., 2020) reduced alcohol-related incidents on an Air Force training base relative to the preimplementation year (Klesges et al., 2013). MET also shows promise in addressing PTSD treatment engagement. Among veterans in a PTSD treatment group, MET increased PTSD treatment attendance and retention (Murphy et al., 2009). Thus, MET has shown promise for engaging individuals with either PTSD or SUD in treatment and in reducing substance use, but the efficacy of MET in the context of comorbid PTSD/SUD remains unclear.

Current study

The Check-Up model (Walker et al., 2007) is an MET designed to engage non–treatment-seeking individuals and increase motivation to change risky behaviors. By providing anonymous services to people who have questions about their drinking but are not in treatment, the intervention avoids several barriers to traditional care for active-duty military (e.g., loss of confidentiality, stigma, inconvenience, impact on career). The Warrior Check-Up project (WCU), a randomized clinical trial (RCT), evaluated the use of an MET Check-Up model, adapted specifically for Army personnel to address SUD, as compared with an active comparator—an educational information session (Walker et al., 2017). Both the MET and educational interventions had positive effects on drinking outcomes; however, MET had significantly stronger effects. Although PTSD was not a specific target of either intervention, personalized feedback about the relationship between symptoms of posttraumatic stress and alcohol use was a component of the MET intervention, but not a part of the educational condition. Given the need for novel approaches to co-occurring PTSD/SUD in military populations and promising research on MET, the present study explores how provisional PTSD, or PTSD symptoms above a clinical cutoff, may have affected drinking outcomes within the WCU trial broadly and the MET intervention specifically.

Consistent with past research (Ford et al., 2007; Norman et al., 2012; Rosen et al., 2002), we expected that PTSD/SUD comorbidity would complicate SUD outcomes. However, because decreased substance use can also lead to reductions in PTSD (van Dam et al., 2012), individuals with comorbid PTSD/SUD at baseline could have seen their PTSD remit (i.e., reduce below a clinically significant threshold on a PTSD screening measure) alongside intervention-related reductions in substance use. For those whose PTSD remained unremitted (i.e., above a clinically significant threshold), we expected this continued comorbidity would be associated with worse SUD outcomes. Because alcohol was the most common primary substance of misuse and was the substance associated with intervention gains during the WCU trial, we chose to focus this article on alcohol-related outcomes. First, we hypothesized that baseline provisional PTSD would be associated with poorer alcohol outcomes. Second, we hypothesized that compared with no PTSD at baseline or remitted PTSD, unremitted PTSD following either intervention (MET or education) would be associated with poorer alcohol outcomes. Third, we examined whether the association between provisional PTSD and poorer alcohol outcomes would be lessened in those who received an MET intervention relative to educational intervention. Specifically, we expected that MET might help service members overcome PTSD-related complications of SUD by addressing the relationship between PTSD and substance use and promoting motivation to change.

Method

Procedures

Data were collected during a randomized clinical trial testing an MET intervention for promoting treatment seeking and reducing substance use among soldiers with an untreated SUD (Walker et al., 2017). Eligibility criteria included (a) current alcohol and/or drug use disorder based on criteria in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV; American Psychological Association, 1994), (b) not engaged in SUD treatment at enrollment, and (c) active-duty status in the U.S. Army. Soldiers were excluded from participation if they screened positive for possible psychosis or had an upcoming deployment that would preclude study completion. After providing informed consent, participants completed a baseline assessment and were randomized to receive either the experimental MET intervention or a matched-attention education comparison condition. Participants completed all study activities over the phone, including follow-up assessments at 3 and 6 months after baseline, and received up to $125 for assessments. Study assessors, blind to intervention condition, administered all measures. The University of Washington Institutional Review Board and the Department of Defense Human Research Protections Office approved study procedures.

Participants

Participants were recruited through print advertisements and in-person presentations at a large military installation from November 2011 to February 2014. Recruitment messaging invited soldiers to call our toll-free number to "check in" if they had questions or concerns about their drinking or drug use. Messaging also emphasized that participation was confidential, nonjudgmental, phone-based, and included a $125 incentive. Of the 429 active-duty soldiers who called and completed the eligibility screen, 290 met criteria, and 242 completed the baseline assessment and enrolled. Attrition was low, with 86.8% completion at 3-month follow-up

and 81.4% completion at 6-month. Completion rates did not significantly differ by treatment group.

The enrolled sample (n = 242) was predominantly male (92.1%) and from lower enlisted ranks (E1–E4; 56.7%). The mean age was 28.0 years (SD = 6.3). Persons of color comprised 40.0% of the sample, and 18.2% of participants endorsed "Hispanic or Latina/o" ethnicity. Most participants (74.4%) served at least one deployment in Iraq or Afghanistan before study enrollment.

Measures

Posttraumatic stress. On the Posttraumatic Stress Checklist–Specific version (PCL-S; Bliese et al., 2008; Keen, 2008), respondents were asked to "consider the most stressful event" they experienced and report how much, in the past 30 days, they were distressed by 17 symptoms defined by the DSM-IV-Text Revision (TR) (American Psychiatric Association, 2000)—the current DSM version at the time of the parent trial. With response options ranging from 1 (*not at all*) to 5 (*extremely*), the sum score ranges from 17 to 85. The PCL-S does not assess whether the "stressful event" meets the DSM-IV-TR definition of trauma (Criterion A). For the present study, we therefore defined "provisional PTSD" as meeting a clinically significant threshold based on DSM-IV-TR criteria for symptom clusters B, C, and D (Wilkins et al., 2011). Consistent with scoring recommendations (Blanchard et al., 1996), symptoms with a rating of at least 3 (*moderately*) were considered to be present. Reviewing 18 studies, McDonald and Calhoun (2010) recommended this approach to scoring the PCL-S as having favorable diagnostic accuracy.

Substance use. All analyses were secondary analyses of a larger RCT (Walker et al., 2017); therefore, we focused only on substance use outcomes that had main or interactive effects of treatment condition or time in the primary analyses. Although the study included both primary AUDs and other SUDs, the majority of individuals identified alcohol as their primary substance. The significant outcomes in the RCT were all alcohol use outcomes (drinking frequency, drinks per week, alcohol-related consequences, and AUD diagnoses), as detailed below, rather than other substance use outcomes.

(A) *Alcohol consumption:* Two items from the Daily Drinking Questionnaire (Collins et al., 1985) were used to measure past-30-day drinking behavior. To assess drinking frequency, participants also reported how often they consumed alcohol over the past 30 days, with 11 response options ranging from "never" to "every day." Responses were recoded to represent number of drinking days per week. To assess drinking quantity, respondents reported the typical number of drinks they consumed each day of a typical week over the past month. These values were summed to indicate "drinks per week."

(B) *Alcohol-related consequences:* The Short Inventory of Problems–Alcohol and Drugs (Blanchard et al., 2003) is a 15-item inventory of negative consequences experienced in the past 90 days as a result of "drinking or drug use." The measure covers five domains (physical, social, interpersonal, impulse, and intrapersonal) and has strong psychometric properties (Bender et al., 2007; Blanchard et al., 2003; Forcehimes et al., 2007). Six items were added to assess military-specific consequences, such as not obtaining promotion, being called up during off-duty hours while intoxicated, and having a drop in physical training score because of substance use.

(C) *Alcohol use disorder:* The Psychoactive Substance Use Disorder section of the Structured Clinical Interview for DSM-IV (First et al., 2002) was administered at baseline, 3-month, and 6-month assessments to diagnose alcohol abuse or dependence. To be consistent with the changes to DSM-5 (American Psychiatric Association, 2013) diagnostic criteria implemented after collection of these data, alcohol abuse and dependence diagnoses are interpreted as proxy diagnoses for mild and moderate/severe AUD, respectively. Such an interpretation is consistent with implications of studies comparing the two diagnostic approaches (e.g., Dawson et al., 2013; Goldstein et al., 2015). Assessors used important events in the respondent's life to anchor a 90-day referent period.

Treatments

Both interventions were personalized and delivered individually via one 60-minute telephone session. Counselors were master's-level clinicians who received weekly supervision from an experienced motivational interviewing trainer. Details regarding counselor training and treatment fidelity are described elsewhere (Walker et al., 2017).

Motivational Enhancement Therapy. A personalized feedback report (PFR) was created based on the participant's baseline assessment responses and sent before their counseling session. The counselor used motivational interviewing skills throughout the session and reviewed the PFR with the participant. The PFR included normative perceptions of substance use, summaries of alcohol and drug use, consequences of use, risk factors (e.g., family history, tolerance to alcohol, other drug use, and PTSD symptoms), and life goals. The intervention included content and feedback on PTSD symptoms (and rating of symptom severity by mild, moderate, or severe), and how PTSD may increase risk of problematic drinking.

Comparison condition—education. The comparison condition consisted of educational information on alcohol and other drugs using a didactic style. Participants received information on alcohol and blood alcohol concentration based on Alcohol Skills Training Program (Fromme et al., 1994) content. Participants also chose one or two additional information modules on other substances.

Data analyses

Three groups were created: (a) individuals meeting criteria at baseline for provisional PTSD, defined above, that remitted by 3 months (hereafter, "Remitted PTSD at 3-months"); (b) individuals meeting provisional PTSD criteria at baseline that was unremitted at 3 months ("Unremitted PTSD at 3-months"); and (c) individuals who did not meet criteria for provisional PTSD at baseline, regardless of 3-month symptoms ("No Baseline PTSD"). First, group differences were evaluated via analyses of variance and chi-square tests for continuous and categorical variables, respectively. Second, intent-to-treat analyses were used to evaluate differential treatment effectiveness on 6-month drinking outcomes based on PTSD at baseline. Third, intent-to-treat analyses were conducted to evaluate differential treatment effectiveness on 6-month outcomes by PTSD remission. The three groups were represented by two dummy variables, with No Baseline PTSD as the reference group. Treatment condition was represented by one dummy variable (*MET* = 1, *education* = 0).

Intent-to-treat regression models were estimated separately for each outcome (i.e., drinking frequency, drinks per week, alcohol-related consequences, mild AUD, and moderate/severe AUD). Participants missing provisional PTSD data at baseline (n = 6), 3-month follow-up (n = 41), or both (n = 2) were retained in intent-to-treat models by allowing all exogenous variables to covary. For each model, a "baseline covariate" was included as a predictor to control for the level of the outcome variable at baseline. Main and interactive effects of treatment condition and PTSD dummy variables were also examined; significant interactions were probed by computing simple main effects. Drinking frequency included noninteger values (e.g., average of 0.5 drinking episodes per week reflecting two times per month over the past 30 days) and was therefore modeled as a continuous variable using maximum likelihood with robust standard errors. Typical drinks per week and alcohol-related consequences both yielded nonnegative integer values that were positively skewed and were therefore modeled as count variables with a negative binomial distribution and a log link. Exponentiated estimates were interpreted as count ratios (CRs; also known as rate ratios). Mild and moderate/severe AUD were both dichotomous variables modeled using a binomial distribution and a logit link. Exponentiated estimates from these logistic regressions were interpreted as odds ratios. Models were estimated using maximum likelihood in Mplus Version 8 (Muthén & Muthén, 2018).

Results

Descriptives

Participants were 242 soldiers randomly assigned to MET (n = 120) or education (n = 122). Half (50.9%; n = 119) met provisional PTSD criteria at baseline; of these, 55.8% (n = 53) continued to meet criteria at the 3-month assessment (i.e., unremitted PTSD). Neither random assignment to condition nor condition completion differed significantly between baseline or unremitted provisional PTSD (Table 1).

Baseline PTSD

Regressions were conducted to determine whether treatment outcomes at 6 months differed by baseline PTSD (Table 2). The baseline covariate significantly predicted each outcome. After controlling for baseline moderate/severe AUD, baseline PTSD was associated with a greater likelihood of moderate/severe AUD at 6-month follow-up (OR = 3.06, p = .015). No other main effects were significant. In addition, treatment effectiveness did not differ as a function of baseline PTSD for any outcome.

PTSD remission

Next, regressions were conducted to determine whether 6-month treatment outcomes differed by 3-month provisional PTSD remission status, relative to a group with no baseline PTSD (Table 3). The baseline covariate significantly predicted each outcome. Controlling for the baseline value of each respective outcome, there were no other significant predictors of 6-month drinking frequency, consequences, or mild AUD. However, there was a main effect of PTSD group for moderate/severe AUD. Specifically, individuals with unremitted 3-month PTSD were more likely to meet criteria for moderate/severe AUD at 6 months relative to individuals with no baseline PTSD (OR = 4.53, p = .007); individuals with no baseline PTSD and remitted PTSD at 3 months did not differ (OR = 1.46, p = .538).

There was a significant interaction between baseline PTSD and treatment condition for one outcome: drinks per week (Figure 1). Probing this interaction, there was no effect of treatment condition for those with no baseline PTSD (CR = 1.02, p = .914) or unremitted PTSD at 3 months (CR = 0.81, p = .482), but there was a significant effect of MET relative to education on 6-month drinks per week for individuals with remitted PTSD at 3 months (CR = 0.41, p = .005). That is, among individuals whose baseline PTSD remitted by 3 months, MET resulted in 59% fewer drinks per week at 6 months relative to education. Simple main effects of treatment were also considered by PTSD group. For individuals in MET, those with remitted PTSD reported fewer drinks per week at 6 months than those with unremitted PTSD (CR = 0.45, p = .021) and those without PTSD (CR = 0.44, p = .006); the unremitted and no-baseline-PTSD groups did not differ (CR = 0.98, p = .943). For individuals within the education condition, there were no differences between PTSD groups (all ps > .386). Although other drinking outcomes (drinking frequency, consequences, mild AUD) evidenced

Table 1. Descriptive statistics by provisional PTSD group

Variable	Overall (n = 242)	No PTSD at baseline (n = 98)	Remitted PTSD at 3 months (n = 42)	Unremitted PTSD at 3 months (n = 53)	p
Assigned to MET	49.6%	50.0%	45.2%	47.2%	.862
Completed intervention	83.1%	89.8%	92.9%	88.7%	.783
PTSD severity					
Baseline	45.75 (16.50)	[ab]32.24 (10.53)	[ac]54.40 (7.42)	[bc]60.13 (12.04)	<.001
3 months	39.66 (17.12)	[a]30.64 (12.75)	[b]34.60 (10.22)	[ab]59.40 (10.72)	<.001
6 months	37.70 (16.39)	[ab]29.33 (12.44)	[ac]38.03 (11.57)	[bc]54.27 (14.25)	<.001
Drinking frequency					
Baseline	4.34 (2.17)	4.29 (2.03)	4.20 (2.15)	4.58 (2.33)	.450
3 months	2.95 (2.42)	2.80 (2.36)	2.52 (2.12)	3.10 (2.62)	.497
6 months	2.68 (2.41)	2.62 (2.22)	2.30 (2.33)	3.09 (2.77)	.331
Drinks per week					
Baseline	31.54 (26.37)	32.24 (29.10)	27.79 (23.57)	32.82 (29.26)	.632
3 months	18.52 (21.00)	18.91 (22.47)	12.19 (11.96)	18.83 (21.06)	.169
6 months	15.41 (17.34)	15.38 (16.80)	12.46 (16.07)	16.19 (17.86)	.581
Consequences					
Baseline	5.17 (4.53)	[a]4.09 (3.49)	5.40 (4.75)	[a]6.13 (4.71)	.012
3 months	4.49 (4.99)	[a]3.65 (4.45)	[b]3.05 (3.71)	[ab]7.06 (5.75)	<.001
6 months	3.53 (4.35)	[a]2.69 (3.67)	3.42 (4.98)	[a]4.57 (4.24)	.049
Mild AUD					
Baseline	82.2%	81.6%	88.1%	81.1%	.598
3 months	35.9%	[a]31.6%	[b]23.8%	[ab]49.1%	.024
6 months	27.6%	[a]19.4%	[b]18.4%	[ab]44.4%	.003
Moderate/severe AUD					
Baseline	82.6%	85.7%	88.1%	81.1%	.614
3 months	37.3%	[a]32.7%	[b]23.8%	[ab]54.7%	.004
6 months	28.6%	[a]18.3%	[b]21.1%	[ab]53.3%	<.001

Notes: Means (standard deviations) or percentages are represented. Omnibus p value corresponds to analyses of variance for continuous variables and chi-square tests for categorical variables. Values with the same superscript on a given row are significantly different at $p < .05$. The PTSD subgroups (No Baseline, Remitted at 3 months, Unremitted at 3 months) are presented for the set of participants (n = 193) with complete data on baseline and 3-month provisional PTSD. PTSD = posttraumatic stress disorder; AUD = alcohol use disorder.

patterns in the same direction, no other interactions were statistically significant.

Discussion

This is the first known study to examine the impact of provisional PTSD on a substance use–focused MET intervention. Motivational interviewing and METs are commonly used as standalone interventions to decrease problematic substance use directly and to build treatment engagement and readiness to change (DiClemente et al., 2017). However, despite high rates of comorbid PTSD among SUD populations, the impact of PTSD on treatment outcomes—and in particular unremitted PTSD—has not previously been studied within brief alcohol interventions or MET. Findings demonstrated partial support for our hypotheses. Unexpectedly, we did not find many differences between those with and without provisional PTSD at baseline in treatment outcomes, with the exception of finding that baseline PTSD predicted greater 6-month rates of moderate/severe AUD. We also found that unremitted PTSD following treatment was associated with higher rates of subsequent moderate/severe AUD. Despite this, descriptive statistics suggest that even for participants who maintained PTSD through the 3-month follow-up, there were improved drinking outcomes that were clinically significant (reduction from 32 drinks per week at baseline to 16 by the 6-month follow-up on average). Those whose PTSD remitted by the 3-month follow-up looked very similar in alcohol outcomes to participants who did not have PTSD at baseline. Together, these findings suggest that among soldiers, having provisional PTSD does not prevent benefit from a brief, low burden substance use intervention.

Based on our findings, remission of PTSD may serve as an early prognostic indicator of long-term drinking changes. This may be because of a variety of factors. The self-medication hypothesis is the leading theoretical model explaining PTSD/SUD comorbidity (Haller & Chassin, 2014; Hawn et al., 2020). It may be that for those soldiers who recover from their PTSD, trauma-related cues evoke less craving. Indeed, physiological arousal when confronted with trauma cues (e.g., memories of the traumatic event or negative emotions) can increase cravings, distress, or subsequent relapse into substance use (Coffey et al., 2006, 2010; Gielen et al., 2016; Norman et al., 2007; Sinha, 2008). Although we found that remitted PTSD was associated with more positive drinking outcomes, this study does not tell us who is more or less likely to remit from PTSD in the context of comorbid SUD or in the context of an SUD-focused intervention. Coping

Table 2. Model results predicting 6-month outcomes by baseline provisional PTSD (n = 242)

DV	Predictor	*B*	*SE*	β/CR/ OR[a]	*p*	R^2
Drinking frequency (continuous)						16%
	Baseline covariate	0.43	0.08	0.39	<.001***	
	Treatment condition	-0.14	0.41	-0.03	.729	
	Baseline PTSD	0.16	0.43	0.03	.710	
	Baseline PTSD × Treatment Condition	-0.48	0.66	-0.09	.466	
Drinks per week (count)						2%
	Baseline covariate	0.02	0.00	1.02	<.001***	
	Treatment condition	0.00	0.16	1.00	.988	
	Baseline PTSD	0.14	0.18	1.15	.449	
	Baseline PTSD × Treatment Condition	-0.44	0.27	0.64	.108	
Consequences (count)						3%
	Baseline covariate	0.12	0.02	1.12	<.001***	
	Treatment condition	-0.08	0.27	0.92	.768	
	Baseline PTSD	0.19	0.23	1.21	.424	
	Baseline PTSD × Treatment Condition	-0.23	0.34	0.80	.501	
Mild AUD (dichotomous)						18%
	Baseline covariate	1.92	0.76	6.82	.011*	
	Treatment condition	0.22	0.51	1.24	.667	
	Baseline PTSD	0.88	0.47	2.41	.063	
	Baseline PTSD × Treatment Condition	-0.17	0.68	0.84	.801	
Moderate/severe AUD (dichotomous)						24%
	Baseline covariate	2.07	0.76	7.89	.007**	
	Treatment condition	-0.58	0.53	0.56	.277	
	Baseline PTSD	1.12	0.46	3.06	.015*	
	Baseline PTSD × Treatment Condition	-0.14	0.70	0.87	.836	

Notes: Continuous outcomes were modeled with maximum likelihood estimation with standard errors robust to nonnormality. Count outcomes were modeled with a negative binomial distribution and a log link. Note that McFadden's Pseudo-R^2 was reported for count data, computed by comparing log likelihood values in the full model to an empty, intercept-only model. Dichotomous outcomes were modeled with a binomial distribution and a logit link. PTSD = posttraumatic stress disorder; DV = dependent variable; CR = count ratio; OR = odds ratio; AUD = alcohol use disorder. [a]Standardized estimates (β) are reported for continuous outcomes; CR are reported for count outcomes; OR are reported for dichotomous outcomes.
*p < .05; **p < .01; ***p < .001.

motives and trauma-induced craving may be two areas to explore in future studies.

In addition, this study found that individuals whose baseline provisional PTSD had remitted by 3 months reported fewer drinks per week at 6 months—but only if they had received MET. This suggests several possibilities meriting future research. One possibility is that individuals whose PTSD was less chronic/persistent at baseline responded more effectively to MET in the long run. Given that PTSD was not assessed through a clinical interview, and we did not assess exposure to a Criterion A trauma, self-reported symptoms above the threshold for PTSD at both baseline and 3 months (the "unremitted" group) may have reflected individuals more likely to meet criteria for PTSD on a structured clinical interview, such as the Clinician-Administered PTSD Scale (CAPS). Interpreted in this light, the fact that MET efficacy relative to control did not differ between those with no baseline PTSD and unremitted PTSD is promising, and consistent with the lack of differences in baseline PTSD status discussed above. Within this context, the remitted PTSD group may represent individuals who experienced heightened transitory distress at baseline, and when MET was delivered during this potentially ideal high-risk time, alcohol use was mitigated in the long run. A focus on drinking may be an opportunity to raise awareness in some soldiers about symptoms of PTSD and the symptoms' relationship to drinking during times of heightened distress, providing an avenue to create change in both disorders.

Among military populations, treatment of SUD in the context of PTSD comorbidity is complicated by institutional and cultural barriers to mental health or substance use treatment (Acosta et al., 2014; Coleman et al., 2017; Eckart & Dufrene, 2015; Zinzow et al., 2013). Among active-duty soldiers with mental health problems, only 13% used mental health services in the past year (Kim et al., 2010). Command has access to medical records and may be involved in treatment planning. Thus, there are perceived and real consequences related to career promotion, security clearance, and fitness-for-duty determinations (Christensen & Yaffe, 2012; Defense Health Agency, 2019; Delaney et al., 2019), leading to concerns (Gould et al., 2007; Vogt, 2011) and perceptions of stigma that can blunt treatment engagement (Ben-Zeev et al., 2012; Hoge et al., 2004). Our findings suggest that either MET or education may be viable options to address substance use, even among active-duty soldiers with PTSD symptoms in a clinical range, and may provide a window of opportunity to reduce PTSD as well.

Findings should be considered in light of several limitations. First, PTSD was assessed via a verbally administered self-report scale (PCL-S) rather than a gold-standard in-

Table 3. Model results predicting 6-month outcomes by 3-month provisional PTSD remission status (n = 242)

DV Predictor	*B*	*SE*	β/CR/ OR[a]	*p*	R^2
Drinking frequency (continuous)					17%
Baseline covariate	0.43	0.08	0.39	<.001***	
Treatment condition	-0.02	0.42	0.00	.961	
Remitted PTSD at 3 months	0.27	0.55	0.05	.618	
Unremitted PTSD at 3 months	0.47	0.58	0.09	.423	
Remitted PTSD × Treatment Condition	-1.26	0.78	-0.16	.108	
Unremitted PTSD × Treatment Condition	-0.28	0.89	-0.04	.749	
Drinks per week (count)					3%
Baseline covariate	0.02	0.00	1.02	<.001***	
Treatment condition	0.02	0.17	1.02	.914	
Remitted PTSD at 3 months	0.11	0.21	1.11	.603	
Unremitted PTSD at 3 months	0.21	0.24	1.23	.386	
Remitted PTSD × Treatment Condition	-0.92	0.37	0.40	.012*	
Unremitted PTSD × Treatment Condition	-0.22	0.34	0.80	.507	
Consequences (count)					4%
Baseline covariate	0.12	0.02	1.12	<.001***	
Treatment condition	-0.06	0.26	0.94	.828	
Remitted PTSD at 3 months	0.13	0.29	1.14	.655	
Unremitted PTSD at 3 months	0.35	0.26	1.42	.168	
Remitted PTSD × Treatment Condition	-0.79	0.51	0.45	.123	
Unremitted PTSD × Treatment Condition	0.00	0.38	1.00	.993	
Mild AUD (dichotomous)					28%
Baseline covariate	2.27	0.80	9.67	.004**	
Treatment condition	0.16	0.51	1.17	.761	
Remitted PTSD at 3 months	0.43	0.63	1.54	.493	
Unremitted PTSD at 3 months	0.94	0.57	2.56	.100	
Remitted PTSD × Treatment Condition	-1.76	1.20	0.17	.144	
Unremitted PTSD × Treatment Condition	0.82	0.86	2.27	.340	
Moderate/severe AUD (dichotomous)					31%
Baseline covariate	2.35	0.79	10.53	.003**	
Treatment condition	-0.74	0.54	0.48	.170	
Remitted PTSD at 3 months	0.38	0.61	1.46	.538	
Unremitted PTSD at 3 months	1.51	0.56	4.53	.007**	
Remitted PTSD × Treatment Condition	-0.73	1.08	0.48	.502	
Unremitted PTSD × Treatment Condition	0.56	0.86	1.75	.515	

Notes: PTSD = posttraumatic stress disorder; DV = dependent variable; SE = standard error; CR = count ratio; OR = odds ratio; AUD = alcohol use disorder. The reference group for the Remitted and Unremitted PTSD dummy codes is No Baseline PTSD. Continuous outcomes were estimated with robust maximum likelihood. Count outcomes were modeled with a negative binomial distribution and a log link. McFadden's Pseudo-R^2 was computed for counts by comparing log likelihood values in the full model to an empty, intercept-only model. Dichotomous outcomes were modeled with a binomial distribution and logit link. [a]Standardized estimates (β) are reported for continuous outcomes; CR for count outcomes; OR for dichotomous outcomes.
*p < .05; **p < .01; ***p < .001.

terview format, such as the CAPS, intended to diagnose PTSD. Similarly, the study did not assess PTSD Criterion A, as would be done during a CAPS interview. This could mean the PCL-S was more indicative of general distress in response to general stressors rather than PTSD specifically. The PCL-S also reflected DSM-IV criteria for PTSD rather than the most recent diagnostic criteria. Although there is good correspondence generally between DSM-IV and DSM-5 versions of the PCL (Blevins et al., 2015; Wortmann et al., 2016), this does mean that findings may not apply as readily to those using the DSM-5 as a screener for provisional PTSD. In addition, although this sample included a large proportion of soldiers with provisional PTSD, and PTSD was discussed in the MET intervention as a risk factor for SUD, PTSD symptoms were not directly addressed within either intervention. Future studies should examine whether focusing more directly on PTSD symptoms and enhancing motivation to change PTSD itself could directly affect PTSD outcomes. Given that weekly reductions in PTSD symptom severity have been shown to reduce subsequent substance use with little evidence for the converse (Hien et al., 2010), intervening directly on PTSD symptoms within a brief substance use intervention may enhance intervention effects on both PTSD and substance use.

This study also focused solely on examining the alcohol outcomes, rather than examining substance use more broadly. This decision was made because alcohol was the primary substance used in the parent trial, and because the MET intervention was found to have effects on alcohol outcomes, rather than broader substance use outcomes. However, as a consequence, we cannot determine whether PTSD might have affected, positively or negatively, other substance use, or whether the MET intervention might have had an interaction with provisional PTSD on substance use

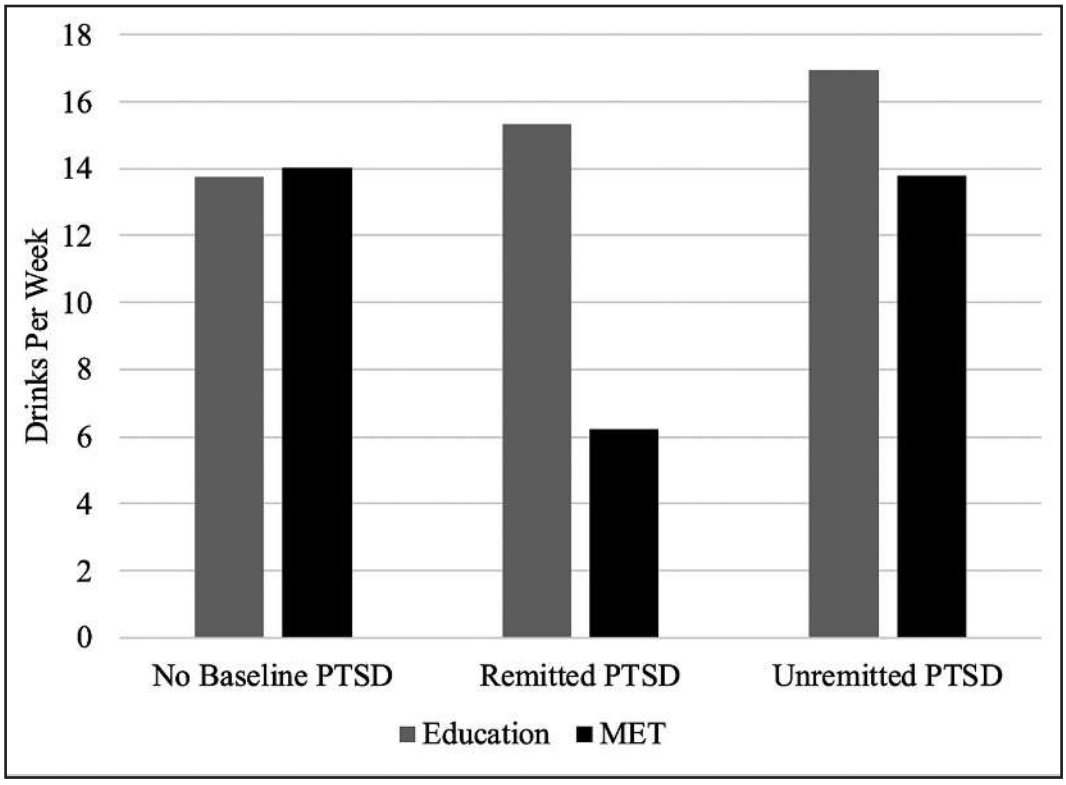

FIGURE 1. Model-implied estimates for drinks per week at 6 months, controlling for baseline drinks per week. *Notes:* MET = motivational enhancement therapy; PTSD = posttraumatic stress disorder. Baseline values of drinks per week were held at the sample average.

outcomes. Further, alcohol-related diagnoses were assessed using DSM-IV criteria. Alcohol abuse and dependence were considered proxies for mild and moderate/severe AUD, respectively. Although the concordance between DSM-IV and DSM-5 has been found to be high and clinical implications minimal (Dawson et al., 2013), differences in diagnostic criteria between the versions warrant replication of current findings with more recent diagnostic assessments. Last, the MET intervention may have created change by prompting treatment seeking for PTSD. However, because the parent trial was focused on substance use outcomes, engagement with PTSD treatment during the trial was not systematically assessed. As a consequence, we were not able to examine PTSD treatment seeking as an outcome or control for the receipt of such PTSD treatment in the current study, but it will be important for future researchers to do so.

Overall, findings offer promise for the effectiveness of MET as a brief alcohol intervention for soldiers despite self-reporting PTSD symptoms in a clinical range. There was no evidence that provisional PTSD or its persistence affected drinking quantity or frequency outcomes deleteriously, although rates of moderate/severe AUD remained higher among those whose PTSD was unremitted. MET may be particularly beneficial to soldiers whose PTSD remits, but more research is needed to understand and replicate this finding.

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